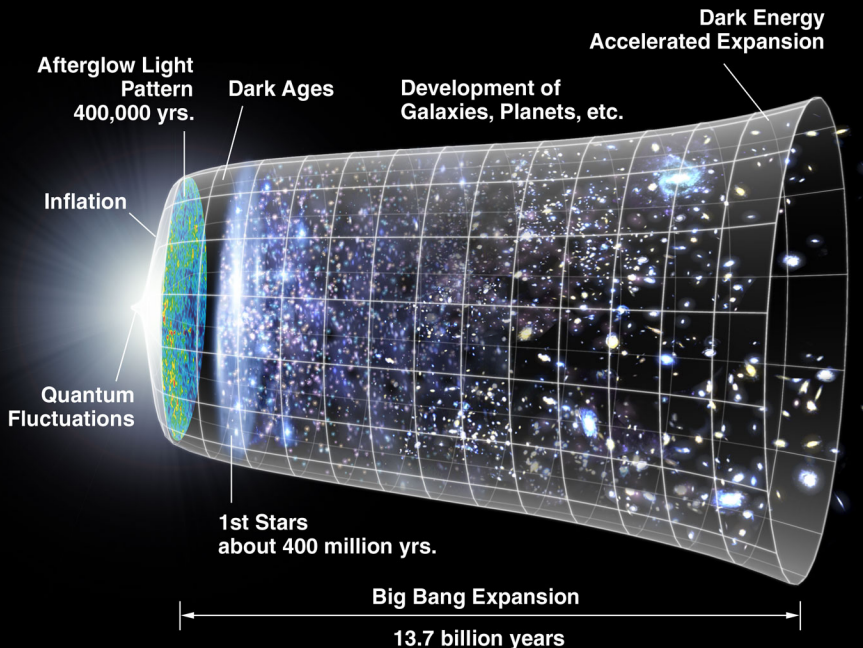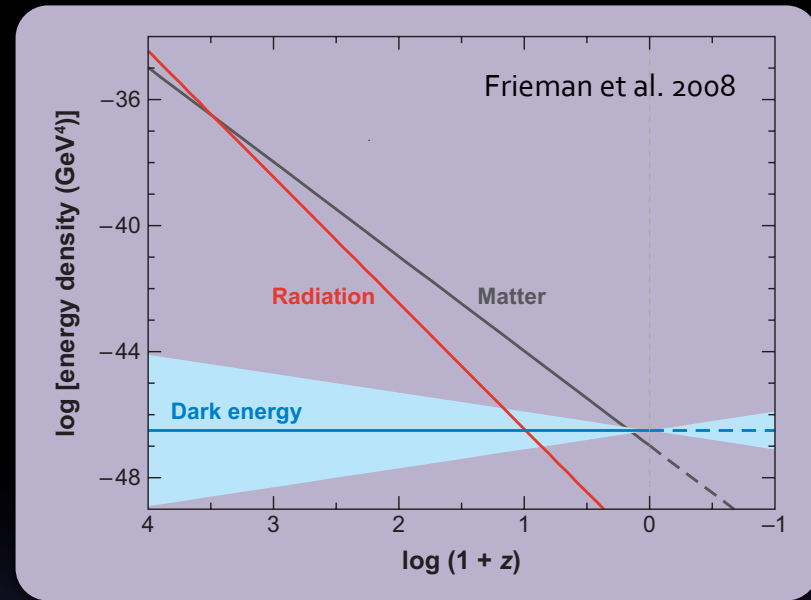# Canadian Hydrogen Intensity Mapping Experiment (CHIME)

Kevin Bandura
CHIME Collaboration
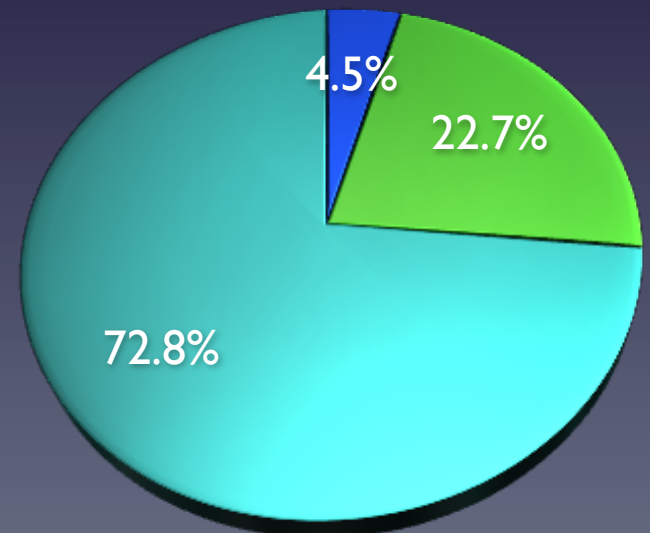
Overview

- Cosmology Overview

  – Baryon Acoustic Oscillations (BAO)

- CHIME Design parameters
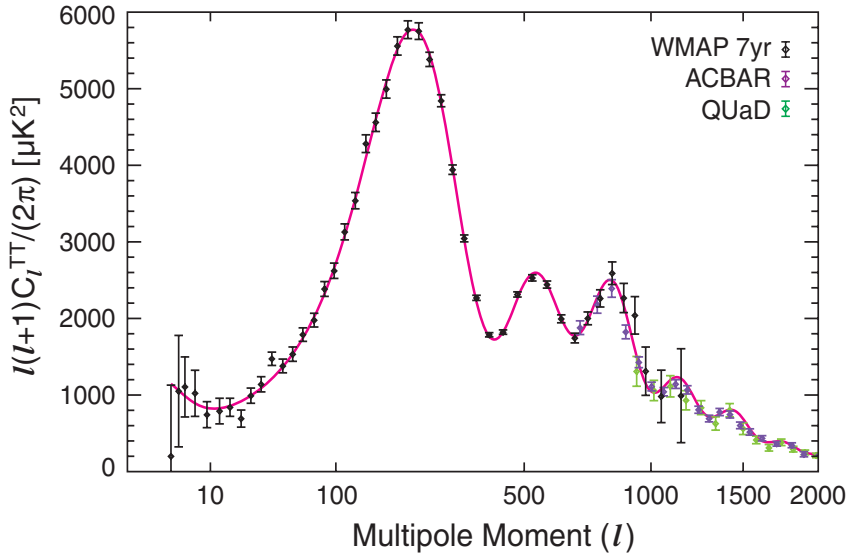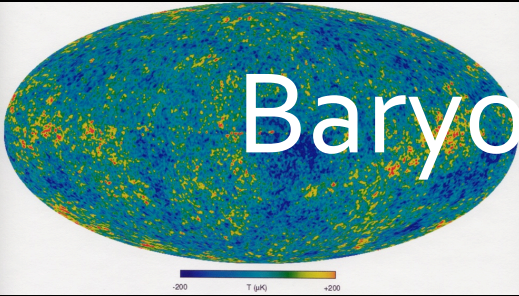
  – Cylinders

  – Hardware

  – Prototype

ΛCDM Cosmology
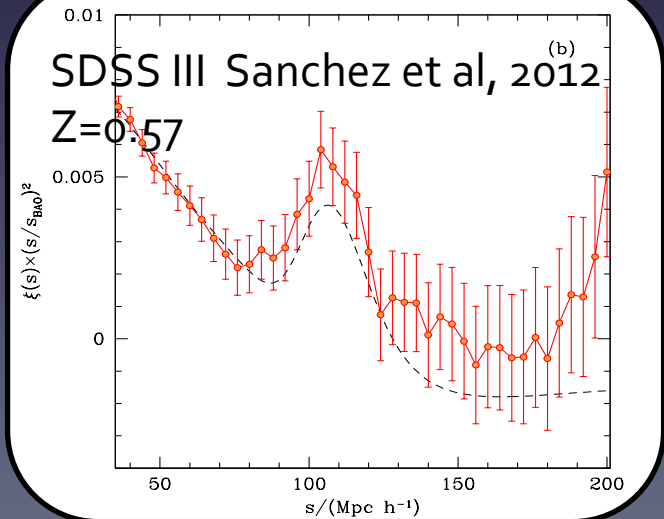

Frieman et al. 2008

NASA / WMAP Science Team

- Baryons
- Dark Matter
- Dark Energy

4.5%
22.7%
72.8%

Baryon Acoustic Oscillations as Dark Energy Probe

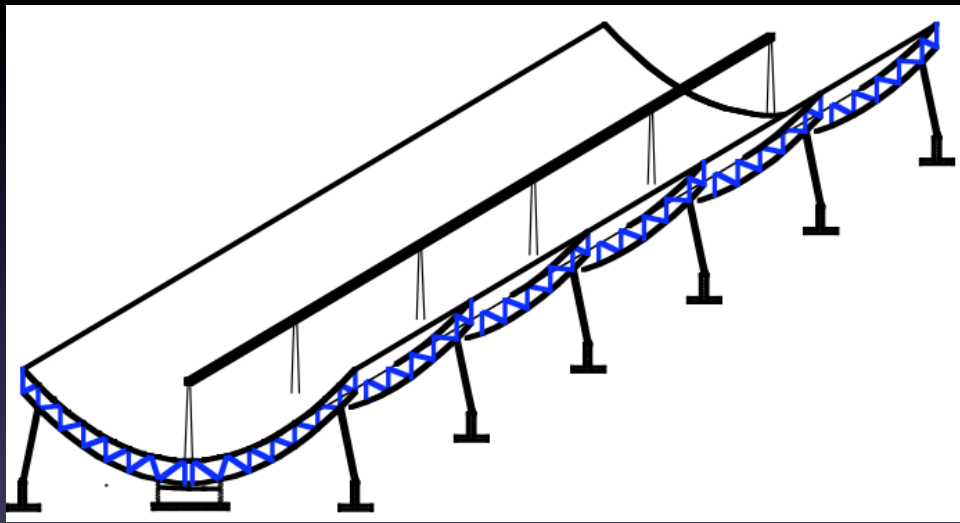Wigglez - Blake et al, 2011
z-=0.6

SDSS III Sanchez et al, 2012
Z=0.57

WMAP Power spectrum along with data from ACBAR and QUaD. Flat ΛCDM model to the *WMAP* data alone
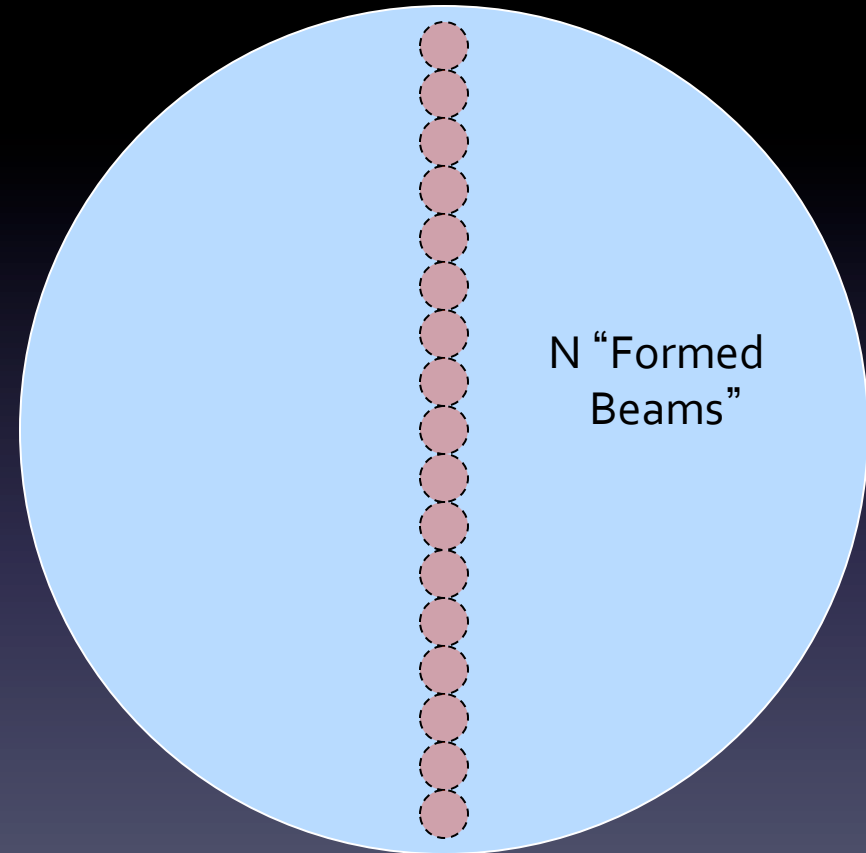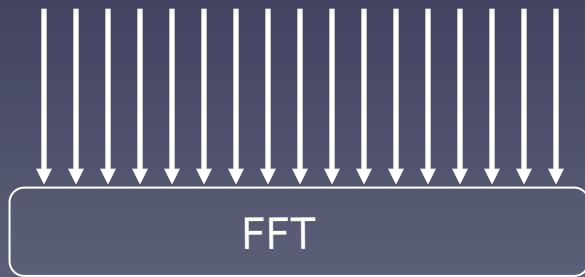Komatsu et al. 2011
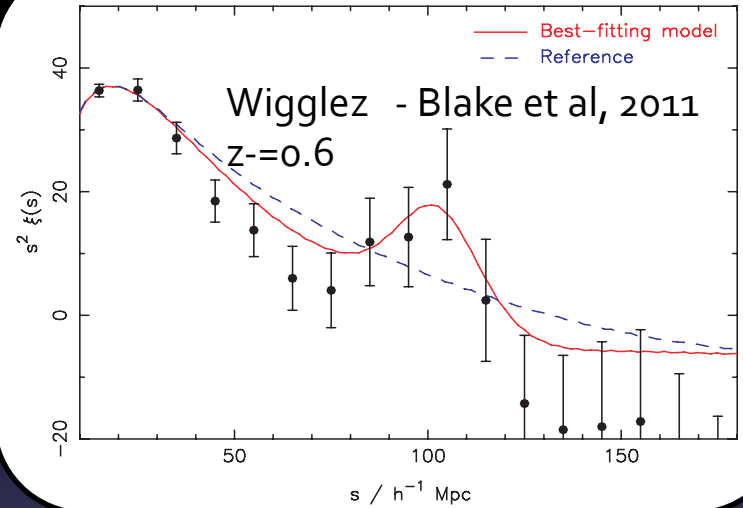
Cylindrical Telescopes

Hybrid: 1D Dish + 1D FFT

N antennas

FFT

N "Formed Beams"
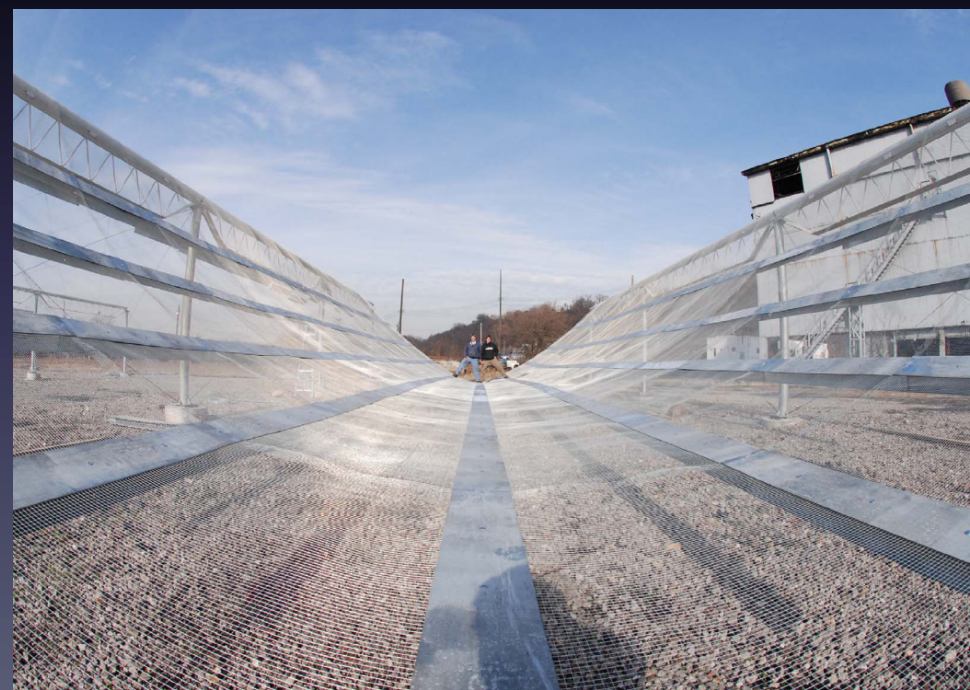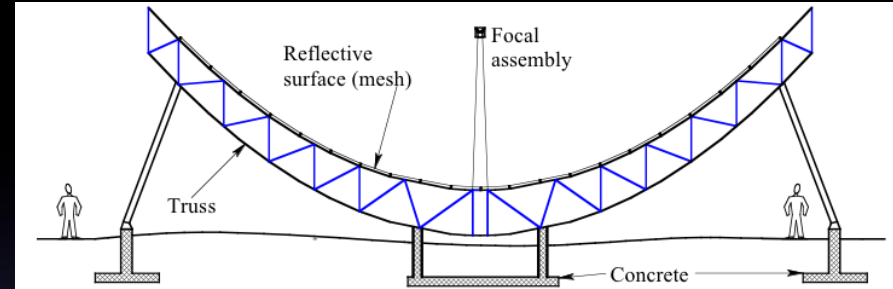
Cylindrical Telescopes

- FFT-Beamform/Interferometer telescope in N-S direction
  - Possibility of full-sky FoV.
  - Form many simultaneous beams on the sky

- Traditional reflector in E-W direction
  - $\lambda/D = 60cm/20m = 1.7$ degree FoV
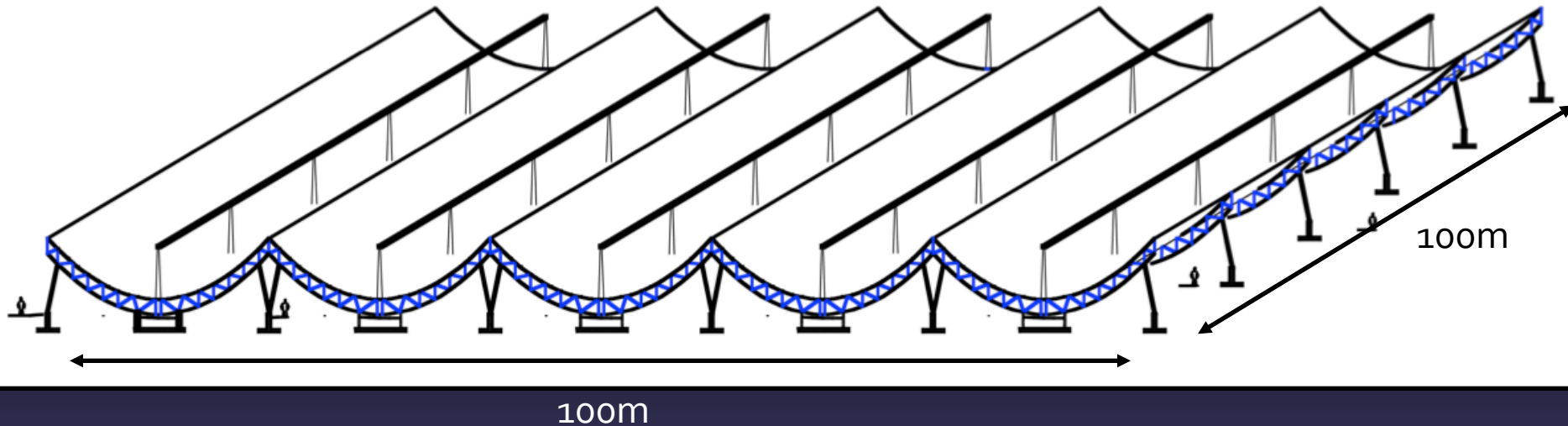 - Drift Scan the sky.
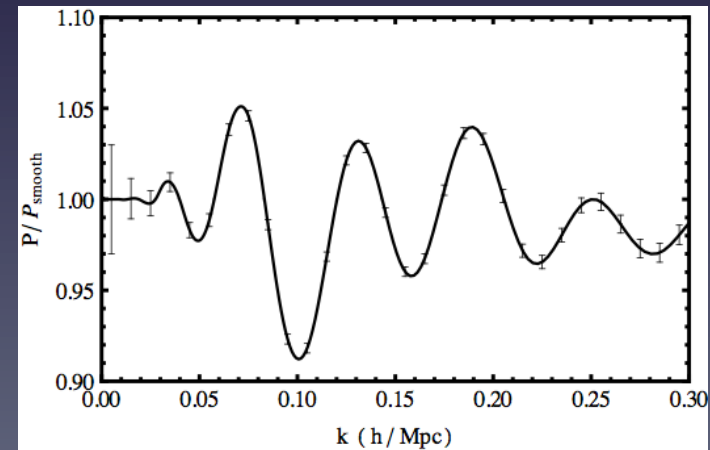

Pittsburgh Cylinder Prototype
(Carnegie Mellon)

CHIME

The Canadian Hydrogen Intensity Mapping Experiment

100m

100m

- Drift scan = 1/2 sky daily
- 400-800MHz band
  - 0.8 < z < 2.5 (for 21cm)
- ~200 Gpc^3 survey volume
- 1MHz frequency resolution
  - 5-10Mpc
- 13'-26' spatial resolution
  - 10-45Mpc

- BAO scale to <10%
  - w_o to ±0.05 (w_o ~ 1)
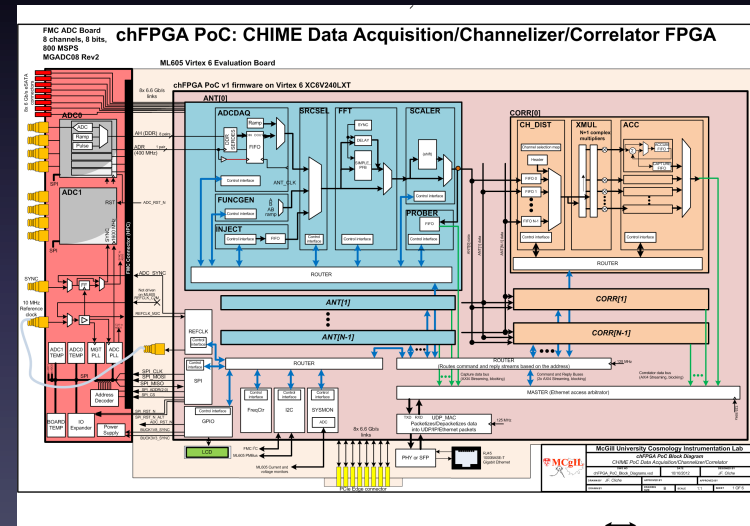 - w_a to ±0.2   (w_a ~ 0)
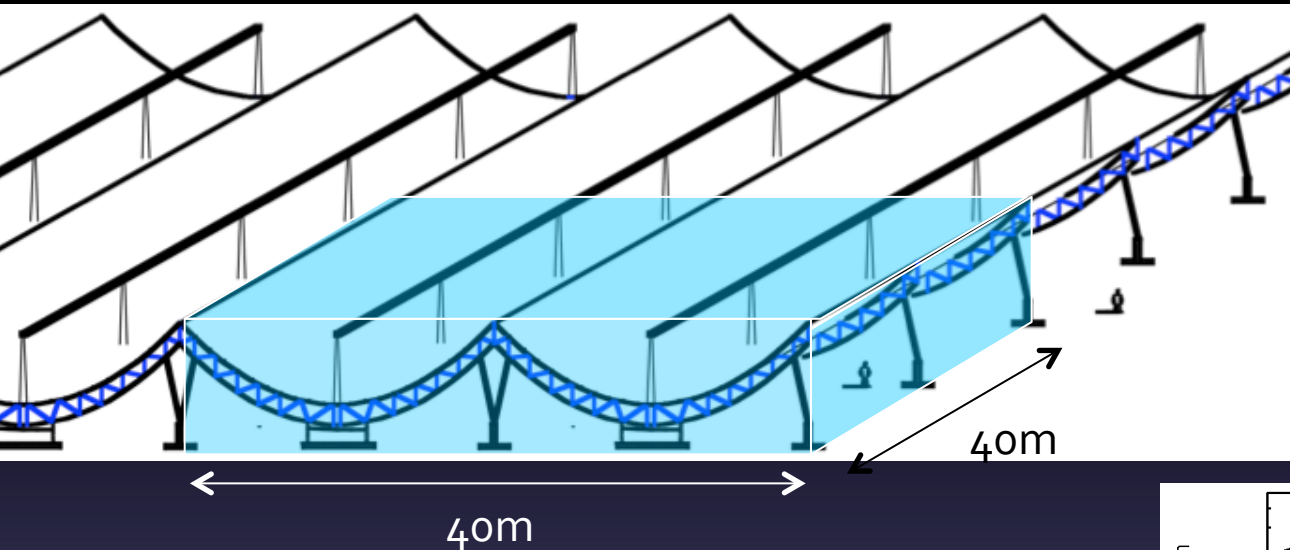

Z=1.5 2 years observing

Hardware
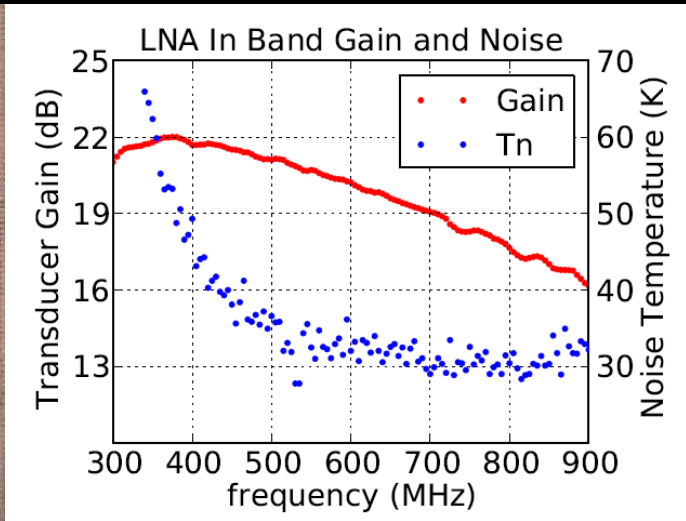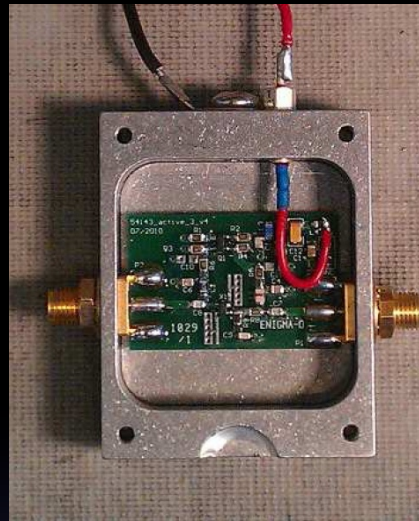
- 4-Square Antenna

- Avago 54143 LNA

- Vertex 6 custom FFT and Corner-turn Network

- AMD GPU Correlator

The CHIME Pathfinder

"an end-to-end hardware, calibration, foreground suppression, and data analysis proof-of-concept for CHIME"

40m

40m

- 64 dual-pol antennas per cylinder (256 total channels)
  - 100's Gpc^3 Survey volume
- Construction beginning
  - Due to be completed *Summer 2013*

- Test CHIME hardware
- Test Calibration Techniques
- Test Foreground Removal
- Preliminary BAO Measurement

neutral hydrogen power spectrum

10^4

10^3

10^2

10^{-2} 10^{-1}

k, (h/MPc)

Signal per 50MHz bin
1 month of pathfinder data